

**Region 2-CPG Modeling Meeting Summary (Revised)**  
**Bioaccumulation Modeling Update Meeting**  
**June 5, 2018**

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**Participants**

EPA Region 2: Diane Salkie, Eugenia Naranjo, Jonathan Clough, Ed Garland, James Wands, Dan Cook

CPG: Mike Johns, Suzanne Replinger, Bill Potter, Rob Law

**Meeting Overview:**

Representatives from USEPA Region 2 and their contractors and representatives from the CPG participated in a face-to-face meeting to discuss progress towards calibration of the LPRSA bioaccumulation model.

**K<sub>OW</sub> and E<sub>D</sub> (discussion of EPA's revised bioaccumulation memo)**

- EPA provided slides regarding corrected bioaccumulation memorandum (dated June 1, 2018), which clarified that EPA would like CPG to consider separating the K<sub>OW</sub> from the E<sub>D</sub> parameter (not the K<sub>D</sub>). The E<sub>D</sub> (chemical-specific dietary transfer efficiency, expressed as a fraction) is not species specific, whereas the K<sub>D</sub> parameter is both chemical- and species-specific. As indicated in the memo, EPA found E<sub>D</sub> values ranging from 0.12 to 0.45 for 2378-TCDD.
- EPA requested that Woodward attempt to calibrate the model, with K<sub>OW</sub> and E<sub>D</sub> separated, with the K<sub>OW</sub> set equal to (or much closer to) the value used in the CFT model (i.e., K<sub>OW</sub> values of 6.65 for 2,3,7,8-TCDD and 6 for tetraCB).
- ACTION: Woodward to move forward with EPA's request to separate these parameters as a calibration option. Woodward will also move forward with research on E<sub>D</sub> parameter values for the other FWM chemicals.

**Calibration Process and Targets:**

- Reviewed overview of calibration process and targets.
- EPA requested that CPG incorporate consideration of fillet data (converted to WB concentrations) for species where this may help improve sample size.
- ACTION: Woodward will incorporate fillet data in calibration/verification of FWM using previously developed fillet-to-whole body relationships.

**Calibration of Parameter Values:**

- **K<sub>OW</sub> for TCDD and tetraCB** – Per discussion above, Woodward will explore separating K<sub>OW</sub> and E<sub>D</sub>, and using a K<sub>OW</sub> that is the same as that for the CFT model.
- **Weight of deposit feeding invertebrates for RM 0-6** – EPA agreed that the proposed calibrated value of 1 mg ww was reasonable (similar to the value developed by Jonathan for this invertebrate group and area).
- **Metabolic rate of TCDD for invertebrates** – EPA agreed that there is limited information regarding this parameter, and that any value within the range was reasonable, including the maximum value as proposed in the model calibration.
- **Dietary absorption efficiency of NLOC and NLOM for invertebrates** – EPA agreed that the proposed calibrated value of 0.4 was reasonable (particularly given the previous conversation with Frank Gobas regarding this parameter), and suggested that a slightly lower value (e.g., 0.3) would also likely be acceptable.

- **Diet for deposit feeding invertebrates** – EPA agreed that the proposed change in the diet for RM 6-14.7 and RM 14.7-Dam was likely reasonable.
  - Group discussed rationale for inclusion of *Macoma* as a deposit feeder (i.e., per direction from Prezant). EPA requested that future calibration work evaluate whether increased sediment consumption for deposit feeders in RM 0-6 resulted in a better model calibration (i.e., reducing the impact of *Macoma* in this area). This may help reduce with systemic under-prediction that is occurring for both chemicals in the RM 0-6 modeling area.
  - Jonathan Clough noted that when he developed diet (did not allow to vary by area), he ended up with about 16% consumption of fluff (similar to Windward's proposed diets for RM 6-14.7 and RM 14.7-Dam).
- **DO saturation for RM 6-14.7** – EPA agreed that proposed calibrated value of 0.8 is reasonable (nominal value was 0.85). Jonathan noted that he came up with an average value for this area of 0.81, further lending support for a value in this range.
- **Metabolic rate of TCDD for American eel** – EPA agreed that the proposed calibrated value of 0.06 is reasonable and recognized that eel are different with regards to bioaccumulation/metabolism as compared with other fish.

ACTION: EPA requested that Windward confirm the acceptable range for this parameter (Jonathan came up with a maximum value of 0.06, rather than 0.082).
- **Lipid fraction for C/O in RM 0-6** – EPA questioned whether the proposed calibrated value of 0.6% was too low for invertebrates.

ACTION: Windward and EPA will research further to look into this and adjust as needed.
- **Metabolic rate of TCDD for carp** – EPA agreed that the proposed calibrated value of 0.007 is reasonable and recognized that carp (as with eel) are different with regards to bioaccumulation/metabolism as compared with other fish.
- **Diet of white perch (all areas)** – EPA questioned whether proposed shift in diet for white perch to 50% fish and 40% invertebrates is reasonable (nominal values were 75% invertebrates and 15% fish).
  - The group discussed that although stable isotope information from the Hackensack showed that white perch were similar (or only slightly higher) in trophic level to mummichog/killifish, similar data from the LPRSA (from river kilometer 7.5) suggested that white perch were actually a full trophic level higher than mummichog.
  - White perch are opportunistic, so these differences may be a result of prey abundance, and the proposed shift in diet appear to be supported by the available literature.
  - ACTION: Both Windward and EPA will do more research into what the diet of white perch.
- **Inputs to CFT model** – Discussed inclusion of CFT model concentration parameters in calibration; EPA indicated that they would like these parameters to be excluded from the calibration process. Feels that over/under-predictions in the bioaccumulation model that may be the result of CFT model inputs should be clearly discussed.
  - Group discussed that incorporation of dynamic model into calibration process should help account for varying CFT model parameters.
  - EPA noted that if CFT inputs were to be varied, it would be important to vary related parameters together (e.g., sediment and porewater), rather than just looking at most influential parameters to model.

- **ACTION:** Windward will proceed with model calibration without calibration of CFT model inputs.
- **ACTION:** Windward will ask Anchor QEA for information regarding spatial evaluation of CFT model performance to ensure that any impact that this has on the bioaccumulation model performance is captured.
- **Water temperature** – EPA requested that Windward look into calibrating the model using a water temperature that is more consistent with the time period during which the fish were collected (Aug/Sept 2009).
  - The group discussed the time period that would be applicable to consider – potentially from the end of winter through the end of sampling (e.g., March/April to Sept).
  - **ACTION:** Both Windward and EPA will conduct more research into temperature and the impact on tissue concentrations of dioxins and PCBs.

#### **Model calibration results**

- Some discussion regarding whether calibration 1 or 2 was preferred. Both parties agreed that more work was needed before selecting a preferred calibration or calibrations.
- EPA provided several suggestions for easy interpretation of model results:
  - Consider a way to incorporate tornado plots with tables showing summary of calibrated parameters with stars illustrating calibrated values and ranges of parameter values.
  - Consider showing table of SPAFs alongside diagonal line plots.
  - EPA noted that they liked the bar charts showing empirical and predicted data.
- **ACTION:** Windward will proceed with refining model calibration and consider ways to incorporate EPA's suggestions for visualization of parameter values and calibration results.

#### **Model verification**

- **Model predictions for 1,2,3,4,6,7,8-HpCDF** – The group discussed how the 3<sup>rd</sup> chemical (1,2,3,4,6,7,8-HpCDF) was selected for bioaccumulation model verification. 1,2,3,4,6,7,8-HpCDF was selected per EPA-directed selection for CFT modeling based on covering a range of K<sub>ow</sub> values.
- **Dynamic modeling** – Discussed model results relative to dynamic modeling and whether observed seasonal fluctuations are realistic relative to what is actually occurring in the river.
  - EPA noted that half-life of TCDD based on juvenile trout is approximately 70-100 days (although this rate is not corrected for growth); potentially able to use equilibration period of dynamic model to help inform this. *[NOTE: After the meeting, additional research found additional information regarding the half-life of TCDD. Tietge et al. 1998 reported that the half-life of TCDD is more than 346 days in adult trout and 300-325 days in carp].*
  - EPA requested that empirical data and steady state results be presented in a way that highlights the time period during which the empirical data was collected.
  - **ACTION:** Windward will continue working on the dynamic model, and will do more research to see if literature information is available to help confirm seasonal fluctuations observed in the dynamic model.
- **Evaluation of individual samples** – The group discussed whether model verification using individual sample performance is needed.
  - May be useful in understanding potential spatial bias of available empirical dataset, although important to frame this carefully.

- Since this exercise only allows for the modification of sediment concentrations (and not the other inputs), care should be taken with how this evaluation is presented (i.e., the model should not be expected to perfectly predict these individual sample concentrations).
- If future work is conducted along these lines, SWACs will be requested from Anchor QEA.
- ACTION: Windward will consider how to revise this evaluation.

#### **Other Items**

- EPA indicated their desire to wrap up bioaccumulation model calibration work as soon as possible.
- The group tentatively discussed meeting again in July.

#### **Summary of Action Items**

- **Requiring follow-up from EPA –**
  - EPA will circulate the revised June 1 bioaccumulation memorandum.
  - EPA will share any literature/additional thoughts they have related to the parameters in question with CPG/Windward (including diet of white perch, lipid fraction of invertebrates [particularly C/Os in R 0-6], and influence of temperature of predicted tissue concentrations).
- **Requiring follow-up from Windward/CPG –**
  - Windward/CPG to send copies of current model code (both steady state and dynamic), along with updated model input files (uncalibrated, calibration 1, and calibration 2).
  - Windward will proceed with refining calibrations based on the feedback received from EPA during this meeting (see detailed action items noted throughout this meeting summary).
- **Requiring follow-up from Windward/CPG and EPA –**
  - Windward and EPA will conduct further research into the parameter values identified above in the discussion of the draft calibrated parameter values
  - Schedule follow-up meeting (July 10?) to work on finalizing model calibration.